BIOE 537: Genetic and Epigenetic Control

Isaac Hilton, PhD

Fall 2019; MW 3 – 4:15pm; BRC 286

Catalog Description: Human diseases are driven by alterations in genetic sequences, cellular transcription, and/or chromatin structure. In this course students will learn how transformative new technologies permit measuring and engineering these alterations, and how bioengineers can leverage these innovative tools to combat human diseases and catalyze advances in biotechnology.

Course Objectives and Learning Outcomes: Students should learn the fundamentals of genetics, epigenetics, and molecular biology from the perspective of a modern bioengineer. Students should also improve their presentation skills, critical thinking, and ability to evaluate scientific literature.

Instructor: Isaac Hilton, PhD. BRC 669. isaac.hilton@rice.edu
TA: Kaiyuan (Kai) Wang. kw40@rice.edu

Textbook: No textbook is required. We will learn from primary scientific articles and reviews.

Grading:
Attendance: 15%
Class Participation: 25%
Oral Presentation: 30%
Group Grant Presentation: 30%

Attendance: Students are permitted 2 absences. Further absences will negatively impact course grade. Extenuating circumstances will be considered on a limited basis.

Class Participation: Active engagement and asking/answering questions is expected of all students. These qualities are displayed by all competent scientists and engineers. Unprofessional behavior and inattention are not appropriate. Use of cell phones, social media, etc. is prohibited during lecture.

Oral Presentation: Students will give a ~20 minute powerpoint (or similar) presentation covering a primary research article selected from a list provided by the instructor. Students must select their presentation date within the first week of the course, otherwise their course grade will be negatively impacted. Presentations will be graded by the instructor and peers.

Group Grant Presentation: Students will divide into four groups and at the end of the semester each group will give a ~30 minute powerpoint (or similar) presentation covering their idea for an NIH R01 proposal relevant to the course material. Presentations will be graded by peers and the instructor. Grading will be based upon creativity and feasibility, as well as NIH scoring metrics including significance, innovation, and approach.

Honor Code: You are expected to strictly adhere to Rice's Honor Code.

Disabilities: Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with the instructor and Disability Resource Center during the first two weeks of class. Discussions will remain as confidential as possible.

Course Schedule:

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	Week	Lecture	Date	Topic
Module 1: Fundamentals	1	1	Mon; 8/26/2019	Course and Syllabus overview
		2	Wed; 8/28/2019	Genetic Variation and the Human Genome
			Mon; 9/2/2019	*NO CLASS - Labor Day*
	2	3	Wed; 9/4/2019	Transcription of Coding Regions in Human Cells
			Mon; 9/9/2019	*NO CLASS - Conference Travel*
			Wed; 9/11/2019	*NO CLASS - Conference Travel*
	3		Mon; 9/16/2019	*NO CLASS - Conference Travel*
			Wed; 9/18/2019	*NO CLASS - Conference Travel*
		4	Mon; 9/23/2019	Transcription of Noncoding Regions in Human Cells
	4	5	Wed; 9/25/2019	Translation of Human Proteins
		6	Mon; 9/30/2019	Epigenetics: DNA Methylation in Human Cells
		7	Wed; 10/2/2019	Epigenetics: Histone Modifications in Human Cells
	5	8	Mon; 10/7/2019	Human Chromatin Structure and the 4D Nucleome
		9	Wed; 10/9/2019	Transcription Factors, Chromatin Remodelers, and Pioneer Factors
Module 2: Technology			Mon; 10/14/2019	*NO CLASS - Midterm Recess*
	6		Wed; 10/16/2019	*NO CLASS - Conference Travel*
			Mon; 10/21/2019	*NO CLASS - Conference Travel*
		10	Wed; 10/23/2019	Assaying the Human Transcriptome
	7	11	Mon; 10/28/2019	Assaying Epigenomic Dynamics
		12	Wed; 10/30/2019	Assaying Chromosome Conformation
		13	Mon; 11/4/2019	Engineering Sequence Information in Human Cells
	8	14	Wed; 11/6/2019	Manipulating the Human Transcriptome
		15	Mon; 11/4/2019	Engineering Epigenetic Signatures in Human Cells
		16	Wed; 11/6/2019	Engineering Human Chromatin Structure
Module 2: Applications	9	17	Mon; 11/11/2019	Building and Delivering Synthetic DNA/RNA/Proteins
		18	Wed; 11/13/2019	Disease Modeling and Clinical Applications
		G1	Mon; 11/18/2019	Guest Lecture 1
	10	G2	Wed; 11/20/2019	Guest Lecture 2
		G3	Mon; 11/25/2019	Guest Lecutre 3
		S-1	Wed; 11/27/2019	Grant Presentations Groups 1/2
	11	S-2	Mon; 12/2/2019	Grant Presentations Groups 3/4
		19	Wed; 12/4/2019	Class discussion - our visions for the future

Schedule subject to change